

Soil Sample Methods

Soil (sediment) samples were collected within the drainages as described below. Soil sampling was concentrated near potential sources of chemicals (Columbia Smelter, Ridley Mine, and Tip Top Mine), then taper off downstream, reducing the frequency of sampling towards the confluence of the Santa Cruz River. Sampling occurred along the Santa Cruz River for nearly 29 miles downstream of the confluence. Soil samples were generally collected at, just prior to, and after major washes converged to characterize each part of the wash.

Sampling locations and intervals were collected as follows:

- Helvetia Gulch/Copper World drainage (Drainage 1): Sampling occurred approximately every 0.25 mile starting 0.5 mile (2 samples) above the Columbia Smelter just south of the historic town of Helvetia, continuing at that interval past the historic Columbia Smelter until the end of the Rosemont property boundary at “F Block”. Sampling then occurred at 1-mile intervals for 5 miles and then at 2 mile intervals for approximately 4 miles to Sahuarita Road. Frequency was targeted at 1 mile intervals, though a 3.75 mile interval was inaccessible north of Walden Grove High School. The final soil sample for Drainage 1 was taken just prior to the confluence with the Santa Cruz River.
- Sampling occurred at 3 points along Dawson Road where the Drainage 1 route appears to be altered by a man-made drainage ditch. The ditch directs storm water along Dawson Road to a wash that crosses and runs west of Country Club Road and Delgado Road. Due to the braided nature of Drainage 1 after it converges with Drainage 3, the majority of the water in Drainage 1 is believed to be diverted to this drainage. Another sample was collected just prior to crossing Sahuarita Road.
- Ridley Mine drainage (Drainage 2): Initial soil samples were taken approximately 250-feet upstream (2 samples) of the Ridley Mine. Two soil samples were taken within the potential source of chemicals, within the tailings of the mine. Sampling occurred just below the mine within the wash channel at an initial interval of 100-feet for 5 samples, a total of 500-feet. The following samples occurred approximately every 1 mile for 12 miles until the final sample was taken within the Santa Cruz River. A total of 20 soil samples were collected in Drainage 2, plus 2 duplicate samples.
- Imerys marble quarry drainage (Drainage 3): Sampling started on Rosemont private land (“F-Block”) in the drainage below the marble quarry. Sampling occurred approximately every 0.25 mile through the Rosemont property, then reduced intervals to every 1 mile for 5 miles past the property boundary where it converges with Drainage 1. Samples downstream of the convergence were then named as Drainage 1. It can also be noted that the drainages from the Tip Top Mine area also connect into Drainage 3 via Drainages 4a and 4b.

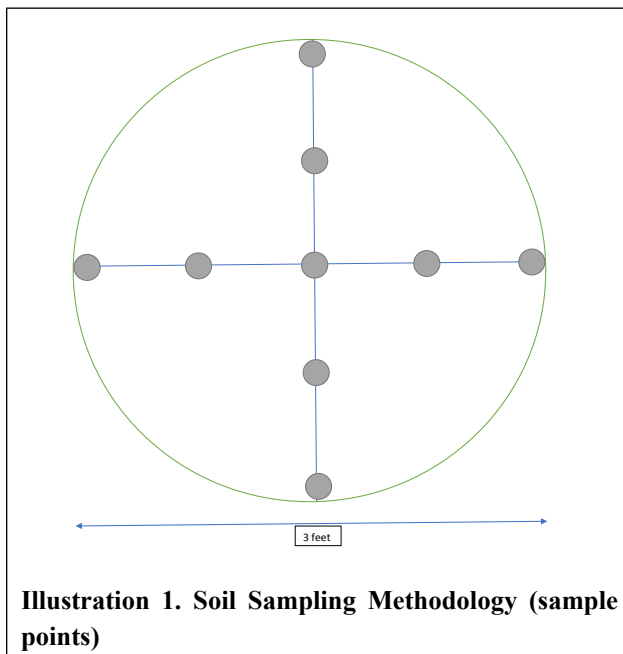
- Tip Top Mine drainages (Drainages 4a and 4b): The Tip Top mine is located on Peach Knob Hill. Two source samples were collected within the tailings of Tip Top mine on each side of the ridgeline. Drainage 4a runs down the east side of the hill while Drainage 4b runs down the west side of the hill. Drainage 4a and 4b were each sampled immediately below the mine tailings and continued at an interval of 100-feet for 5 samples, for a total of 500-feet. The next sample were at 500-feet and then continue every 0.25 mile until the drainage converges with the drainage coming from Imerys (Drainage 3). A sample was collected at the end of each drainage, prior to converging with Drainage 3.
- Additional sampling occurred downstream of Imerys marble quarry in an additional drainage that splits off from Drainage 3 and runs northwest. This drainage splits after both Drainage 4a and 4b converge with Drainage 3. Samples were collected in this drainage at the Kolb Road, Wilmot Road, and Sahuarita Road crossings.
- The Santa Cruz River runs north-to-northwest from Mexico until it converges with the Gila River north of Casa Grande. Drainage 1 converges with the Santa Cruz between Interstate-19 (I-19) and Nogales Highway, 5 miles north of Pima Mine Road. The Santa Cruz River crosses I-19 near San Xavier Road and only runs with stormwater runoff until the effluent waters contribute to the river near Rodger Road. Soil samples were collected at the confluence of Drainage 1 then downstream in intervals of 5-miles or less, where samples were collected opportunistically. A soil sample was also collected just upstream of the confluence, 5 miles south of the confluence at Pima Mine Road, 4.4 miles south at the confluence of Drainage 2, and another 1.4 miles upstream from Drainage 2 at Nogales Highway.
- The Ina Road wastewater treatment plant (WWTP) contributes greater amounts of effluent than the Rodger Road plant. A soil sample was taken prior to the Ina WWTP effluent water, then 1.5 miles downstream followed by 8 samples targeting 0.25 mile intervals. Another 3 samples were collected approximately 1-mile apart, ending at Avra Valley Road. Sampling plans had anticipated the river to be dried up 1.5 miles downstream per previous visits to the river, mimicking plans at the site, concentrating samples near the potential source of contaminants. The Santa Cruz River was found to be flowing during sampling efforts, but the sampling efforts continued as planned despite the river flow.

Sample Collection

Each soil sample consisted of approximately the volume of a sandwich bag. A 30-inch diameter circle sampling frame (hula hoop) was placed in the middle of the drainage, and along both margins of the active channel at each designated soil sampling location. Extraneous surface material, such as rocks, glass, vegetation was removed prior to collecting the sample. Near-surface soil/sediment samples (approximately 1-inch depth) were taken with a tablespoon-sized stainless steel scoop from 9 points within each of the 3 sampling frames as shown on **Illustration 1**.

A composite sample was thoroughly mixed within the zip lock bag. Samples collected south of Sahuarita Road and north of the Ina Road wastewater treatment plant were sieved with a No. 5 sieve. These samples were also characterized for soil color (hue, value, chroma) in the field using the Munsell Color Chart. The zip lock bag was labeled for lab analysis, double bagged, and recorded on a chain of custody prior to submittal to the soil laboratory.

The soil scoop and sieve (when used) were decontaminated between each sample location by spraying Alconox detergent on the instruments, then triple rinsing with distilled water.



Field Data Collection

A tablet with an electronic datasheet was used to collect field data. The sampler names, dates, times, and GPS points in UTM, NAD83 were recorded at each location. Observations about the characteristics of the sample and sampling area were recorded on the form. The Munsell Color was recorded where collected as noted above.

A photograph of each soil sample location was taken with a sample identification label on a dry erase board. Photos were taken upstream and downstream of each location, capturing the whole cross section of the wash. (The photographs of soil/sediment samples can be found in **Photo Log 1**).